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COMPENDIOUS REPORT ON DISK WAVE DRIVE (DIWA)

H. Kleinwächter

Translation of "Kurzmitteilung zum Diskus-Wellen-Antrieb 'DIWA'," Elektronik für Raumfahrt und Atomtechnik, Lörrach, Germany, Press Release, 1 October 1972, 2 pages

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16. Abstract This report covers a novel design together with a variant of a gear motor and of a telemanipulator. An elastically-geared circular disk is made to engage with a rigid bevel gear which has the same pitch but two teeth less than the circular disk at two diametrical locations on its circumference by means of a rotating magnetic field or, in the variant, by sequentially inflated elastic expansion chambers. In this manner, a reduction ratio of several hundred is attained. The telemanipulators are made up of independent universal joint capsules. Each capsule contains a drive motor, a highly reduced gear train as well as angle, torque, and temperature sensors. Current and air conduits are ducted through hollow axles. The space between the articulated arms can be hermetically sealed by means of metal bellows.

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At Klera, there are at present two novel gear motors under development that have many advantages over conventional designs. Fig. 1 shows a diagrammatic sketch of a sinusoidal electromagnetic disk drive. By means of a paired single-pole rotary magnetic field, the variable-gear circular disk (4) is made to engage with the rigid bevel gear (6) at two diametrically opposed points of its circumference which have two teeth less than the circular disk (4) for the same pitch. That way, it has great torque and no backlash, using only two teeth on the fixed bevel gear (6) for one full revolution of the rotating magnetic field. In this manner, a reduction ratio of several hundred can be attained with only one pair of gears. Solid current connections of the synchronous system (2) are also more advantageous than the direct current collector motors used up to now. /1*

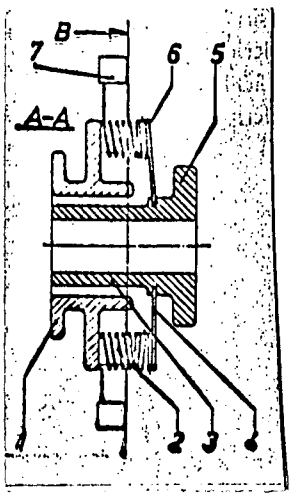

Fig. 1

Fig. 2 shows the variant of a fluidic motor functioning on the same principle where the rotating axial deformation wave of the disk flexspline (18) is generated by at least two diametrically located elastic expansion chambers (22) being sequentially inflated by pressurized gas or by hydraulic fluid. By using

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* Numbers in the margin indicate pagination in the foreign text.

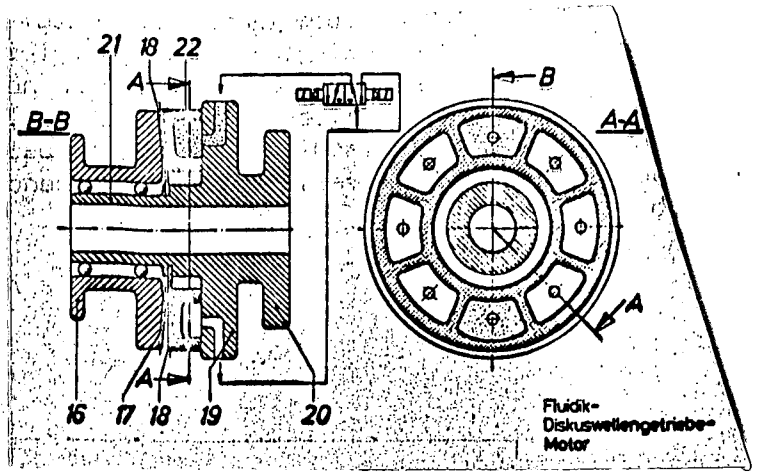

Fig. 2. Fluidic disk shaft gear motor.

fluids with a suitable boiling point, for instance carbon dioxide, circulating in a hermetically closed cycle, such a system with an evaporator and a condenser can be operated directly by solar energy, for instance for an application in space vehicles. In an open control circuit, both drive units can also be utilized as digitally controllable stepping motors.

Of advantage for the efficient design and reliable operation of telemanipulators in atomic and marine engineering as well as in space vacuum are also the hermetically sealed universal joint capsules that are being developed by us. As can be seen in Fig. 3, each telemanipulator arm can easily be structurally assembled solely from independent universal joint capsules. Each capsule contains a drive motor (11), a greatly stepped-down gear unit (5), an angular sensor (16), torque, and temperature sensors. Topologically, the angular sensor is connected with the rotary system through a hollow axle (15). All current conductors and air conduits are led through this hollow axle obviating all coupling loops susceptible to trouble. Due to the limited angle of twist between the two articulated arms (9), elastically extensible or elastically foldable metal bellow seals (10) can hermetically seal off the interior space of the manipulator arms from the surrounding space vacuum.

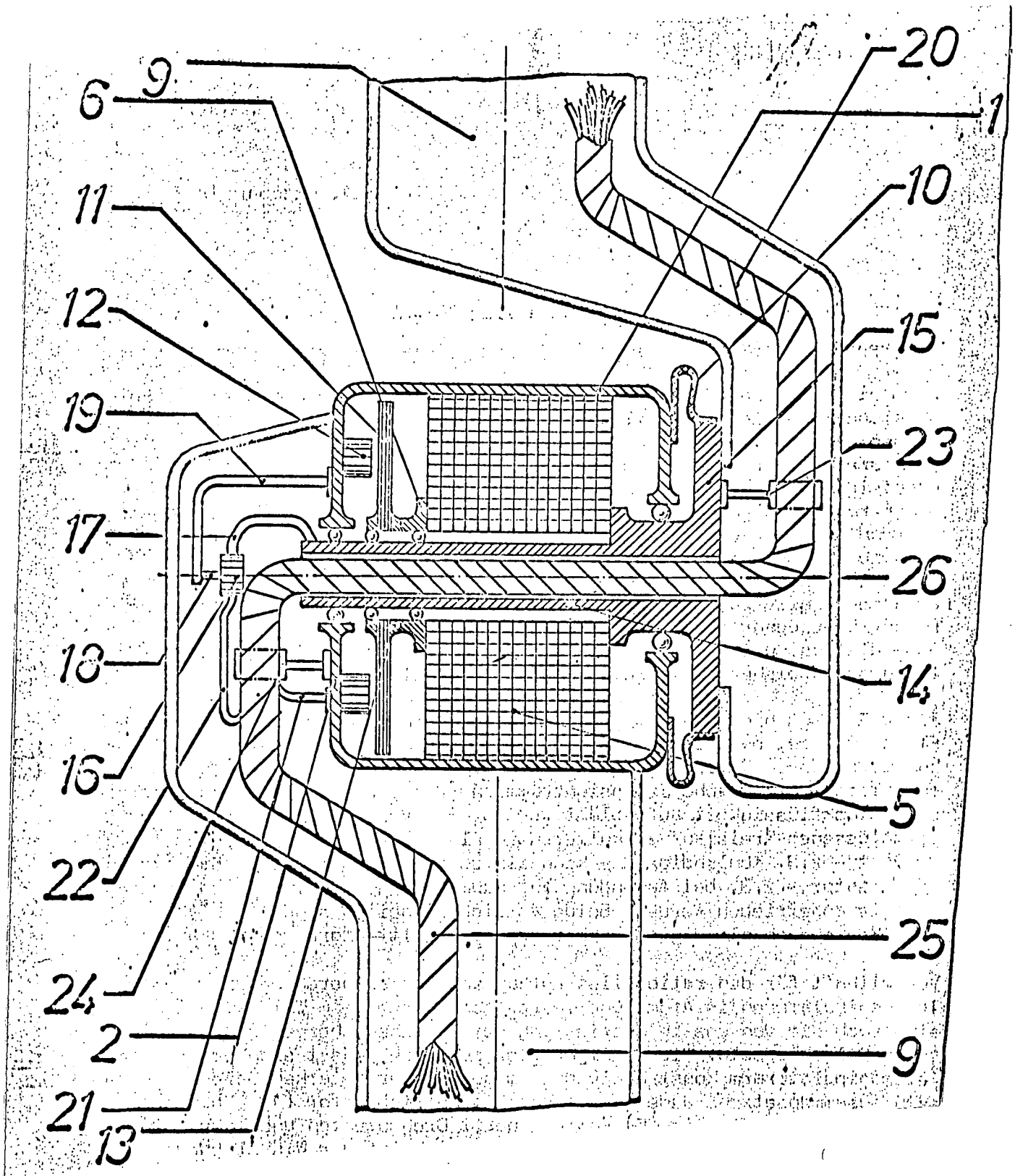

Fig. 3.

/2